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AUTHOR Mahler, Sophia; And Others
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ABSTRACT

A study examined both cognitive and activity rhythms of lessons in a variety of disciplines and teaching styles in the medical school curriculum among 20 faculty members at Ben Gurion University, Israel. Studied were changes which occurred in the rhythms following a teacher training program, and interrelationship among rhythms and size of learning groups. Teachers involved in the study took part in a 4-day workshop, based on microteaching techniques, which aimed at improving teachers' instructional behavior in two dimensions: (1) to replace the traditional teaching modality of lecturing by a pattern which elicits students' self-initiated verbalization; and (2) to use and stimulate the students to use a higher cognitive level of verbal exchange during the lesson. Results showed a significant rise in activity and cognitive levels in teachers' classes following the training workshop; however, the educational gain from the training varied considerably in the different learning groups according to size. Three distinct rhythms of lessons--dramatic rhythm, dynamic rhythm, and static rhythm--were disclosed for both cognitive and activity parameters. There was a prevalence of "static rhythm" after the workshop in all group sizes. (JM)

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CHANGES IN THE RHYTHM OF LESSONS FOLLOWING A TEACHER-TRAINING WORKSHOP IN MEDICAL SCHOOL

Sophia Mahler, Dan E. Benor, M.D.

Faculty of Health Sciences

Ben-Gurion University

and

Pinchas Tamir, Ph.D.

Hebrew University

Correspondence: Dan E. Benor, M.D.

Faculty of Health Sciences

Ben-Gurion University

Beer Sheva 84105, Israel

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The cognitive level of both teachers' and students' verbal activity during an educational experience ("a lesson") is one of the generally accepted criteria for quality of teaching (Flanders, 1970; Hunkins, 1972; Winne, 1979). Others suggest also the criterion of amount of learners' vs. teachers' activity during a lesson (Rowe, 1974; Flanders, 1966; 1970; Sanders, 1966).

However, fluctuations may be observed in both cognitive and activity parameters along any teacher-student educational encounter. These fluctuations define a rhythm of a lesson. It is suggested that study of rhythms of educational experience may throw additional light on both the nature and the quality of the teaching-learning experience. It is further suggested that the study of rhythms may provide an additional tool to assess the effects of teacher-training programs.

The present communication studies both cognitive and activity rhythms of lessons in a variety of disciplines and teaching styles and along all stages of medical school curriculum. Further, it studies the changes which occurred in the rhythms following a teacher-training program. Finally, it attempts to define the interrelationship between rhythms and size of learning groups. All the observations as well as the teacher-training were conducted in the Faculty of Health Sciences, Ben-Gurion University, Beer Sheva, Israel (BGU).

METHOD

The study population consisted of sixty volunteering faculty members, representing 20 clinical, behavioral and basic science disciplines, who were teaching medical students in all the segments of the BGU 6-year curriculum.

These teachers took part in a four-day workshop which aimed at improving teachers' instructional behavior in two dimensions: (a) To replace the traditional teaching modality of lecturing by a pattern which elicits students' self-initiated verbalization; and (b) to both use and stimulate the students to use a higher cognitive level of verbal exchanges during the lesson. The workshop was based on microteaching techniques (Allen & Ryan, 1969), and provided the participants with both group feed-back and individual tutoring. Each teacher had three micro presentations which were analyzed and discussed, and was involved in reviewing an additional 18 presentations of his colleagues. In addition, there was extensive practice in identification of the cognitive level of given questions and statements as well as training in their reformulation in order to raise their cognitive level.

Three lessons given by each participating teacher, all of them within his or her regular curricular activities, were videotaped and assessed prior to the workshop. This assessment yielded an interlesson correlation of .72 to .92, and thus made it possible to establish a baseline for the teacher's pre-workshop performance. Three additional lessons, also within the teacher's routine responsibilities, were videotaped and assessed after the workshop. The criteria for assessing the activity dimension were (a) the lesson time used by the teacher vs. that used by students, (b) the initiator of the observed activity (teacher, student); and (c) the kind of the observed activity (a question, a response to a question, self-initiated presentation, etc.). The criterion for assessing the cognitive dimension was Bloom's taxonomic scale for cognitive domain (Bloom et al., 1956). The two sets of criteria, their possible interactions and their hierarchical relationships are presented in table 1. Both dimensions were quantified using the

Technion Diagnostic System (TDS), which is a direct observational system (Perlberg et al., 1974; Bar-On & Levin, 1974), based on Guttman's Facet Approach (Guttman, 1954), yet capable of assessing each of its dimensions separately.

Table 1 about here

Three five-minute units of each videotaped lesson at 15-20, 30-35 and 45-50 minutes after the commencement of the lesson were assessed. It was felt that earlier periods of time may be influenced greatly by the "camera awareness" phenomenon (Irwin & Perrott, 1981), lateness of some students and engagement in administrative matters. Neither teachers nor students nor cameramen were aware of the time-units which eventually would be assessed.

The assessment was performed by two trained raters simultaneously, each rating one of the two assessed parameters, namely activity or cognitive level. Their training included about 7 hours of practicing in three sessions, until interrater reliability of .90 was achieved on each of the two dimensions Only then was each rater assigned to rate one dimension. Their ratings yielded two scores for each five-minute unit, one for each dimension, ranging from 100 points (lowest, reflecting "teacher talking on a knowledge level") to 600 points (highest, corresponding to "students talk on an evaluation level"). The line which emerges from the scores obtained in each time unit defines the rhythm of the lesson. The rhythm of the activity dimension is entitled the activity rhythm, and the cognitive one is the cognitive rhythm.

Assuming that the learners' group size has a predominant effect on the

rhythm, the observed lessons are divided accordingly into three group size categories: (a) Small groups (S) in which there are 1-4 students; (b) medium size groups (M) of 5-16 learners; and (c) large groups (L) of 17-50 students. The categorization is based on actual reality in the school, stemming from logistic and other curricular considerations rather than upon theoretical or conceptual ones.

The results were analyzed by contrasting the two rhythms and the pre-post workshop differences, in each of the three group sizes.

RESULTS

A conspicuous and significant rise in both activity and cognitive levels was observed following the training workshop. This applied to all group sizes and all time units within the lessons. The mean pre-post workshop increase in the cognitive level over all time units, group sizes and the three lessons was from 167.0 ± 78.0 to 185.7 ± 60.8 points on the 100-600 point scale ($F = 11.58$, $p < .001$) (table 4). The mean increase in the activity level was even greater, from 169.8 ± 70.3 to 218.1 ± 78.9 points on the same scale ($F = 44.10$, $p < .001$) (tables 2 and 4). However, the educational gain from the training varied considerably in the different learning groups according to their size. The greatest gain was observed in medium-size groups on both parameters, and the smallest in small groups on the activity parameter (table 2). The hierarchy between the groups was preserved inspite of the changes, the small groups always scoring the highest on both parameters and the large groups the lowest. The effect of group size was found to be significant for both parameters (table 4).

Table 2 about here

Three distinct rhythms of lessons have been disclosed for both cognitive and activity parameters. The first type, entitled "Dramatic Rhythm," is characterized by a low score for the first time unit, a climax at the second, and some decline in the third, though not reaching the low of the outset. The second type, entitled "Dynamic Rhythm," is the one in which an increase is evident along the lesson units, the last one being the highest; however, the rise is not necessarily a linear one. The third and last type, entitled "Static Rhythm," is distinguished by having the highest score in the first observed time unit, which later is either sustained or declines. In no case was a rhythm found which was the mirror image of the dramatic one; that is, in which the middle unit scored significantly lower than the two ends.

Table 3 and figure 1 present the scores obtained by the different learning groups on each of the two parameters both before and after the teacher-training workshop. The scores represent the mean of the three pre-workshop lessons and that of the three post-workshop ones for each of the three time units.

Table 3 about here

Figure 1 about here

The analysis of variance reveals significant main effects of both the treatment (the training workshop) and the size of the learning group, yet no interaction between the two. Similar results are shown for both cognitive and activity levels (table 4).

Table 4 about here

DISCUSSION

The results suggest that the four-day educational workshops indeed significantly changed the instructional behavior of teachers. After the workshop teachers tended to stimulate and encourage students' verbal activity more, as compared with their pre-workshop performance, and thus to spend less time lecturing. They also acquired the skill to both use and to stimulate higher cognitive levels of verbal activities than were used before.

However, the overall scores for the entire lesson provide but scattered information on what actually happened during the 60 minutes of educational encounter entitled "a lesson." It is thus suggested that the rhythm, based on measuring and contrasting various time units along the lesson rather than the overall score, may enlighten the modification of teachers' instructional patterns following an educational workshop.

The results indicate a dependency of both activity and cognitive dimensions on the size of the learning group. This dependency is not as evident from the overall scores. It is shown that the smaller the learning group, the higher it scores on both parameters. This hierarchy is preserved after the workshop in spite of a considerable increase in both dimension scores and in all lesson segments (with the only exception of partial overlapping in the activity measure of post-workshop medium and small groups). Such a hierarchy indicates that it is easier, and perhaps more expected, to activate a small number of learners than a large audience. However, it is noteworthy that the verbal exchange under such circumstances involves also a higher cognitive level. Further it may be noted that although teachers naturally tend to perform on a higher level while teaching a small group, they still do not necessarily exhaust their potential; even the high levels before the workshop were considerably raised afterwards.

The results indicate a prevalence of the "static rhythm" after the workshop in all group sizes. This rhythm means, as mentioned above, that the highest level of both parameters was at the 15-20 minute phase and then it was either maintained or even decreased. The static rhythm completely replaced both the "dramatic" one in large groups on both dimensions, and the "dynamic" one in small groups on the activity parameter. Moreover, even the sustainance of "dynamic rhythm" on the cognitive measure in small groups has become flatter and showed less variance between the three time units after the workshop; that is, it has become more "static." In medium-size groups, on the other hand, the rhythm has hardly changed, remaining static after the workshop as it was beforehand. These findings mean that following the training program teachers tended to activate students on a higher cognitive level adjacent to the commencement of their lessons and less so towards both their middle and end. This finding deserves clarification.

It may be speculated that the modification in the rhythm stems from a new perception of the teacher's own role. Before the training this self-perception might have been that of a transmitter of factual knowledge. This naturally takes place at the commencement of the lesson, and scores low on TDS because of the intrinsic characteristics of the instrument. Then it might have been followed by evaluation of students' comprehension (questioning) clarification (answering), and demonstration (explaining), all scoring somewhat higher although in the low range of the TDS. In contrast, after the workshop the self perception might have become that of a solicitor, stimulator, leader of a discussion or a resource person, leading to a reverse flow of information from the learners to both the teacher and the peers. Such behavior yields much higher scores on TDS. However, the teacher still has to summarize and

to clarify information, and to stress whatever requires stressing. The nature of such behavior requires teacher's verbal activity towards the end of the lesson, resulting in a declining rhythm. Nevertheless, even if such a fundamental change in the teachers' attitudes towards their educational role did not occur, it still may be the case that the results reflect a replacement of the information transfer phase from its traditional place at the beginning of the lesson towards its end. This means that the teacher was discussing learning products brought up earlier by learners. It should be stressed that both explanations correspond well with the institutional objectives as well as with the workshop's goals. However, other speculated explanations may account for the observed change of the rhythms. The first is based on the ceiling effect. It may be the case that after the training teachers were acting at their utmost capability, naturally leaving no room for a further raise after a high start of the lesson. In other words, it means that the largest effect of the training was exhibited in that segment of the lesson in which the pre-workshop behavior scored the lowest; that is, its beginning.

Another possible speculative explanation is a lack of transfer from the microteaching, practiced in the workshop, to the full scale lesson. This means that the teachers learned how to raise both students' activity and cognitive level during the first part of the lesson, but failed to do so afterwards, falling back to the traditional pattern. Although this explanation is not likely in the light of the results, which even at the last time unit were so much higher than prior to the training, this possibility may be investigated. The long experience with microteaching techniques, however, proves a good generability and transfer to real-life situations (Young, 1969, Borg et al., 1970; Gall, 1978).

Finally, it may be argued that the pronounced proficiency of teachers in the first time unit which turns the rhythm into a "static" one, stems from their "camera awareness." The fact that this did not happen before the workshop does not exclude this possibility, as at that time the teachers had not yet become aware of the experimenter's expectations and thus could not respond to these demands. However, this possibility is highly improbable due to two facts: First, the first time unit is at 15-20 minutes after starting the videotaping; and second, the teachers, students and cameramen were not aware of the time units which eventually were evaluated. The experience with "camera awareness" effect indicates a much shorter period of adaptation (Irwin & Perrott, 1981). Nevertheless, since it seems easier for a teacher to demonstrate proficiency in the activity dimension rather than in the cognitive one, and since the results indeed show higher achievements on the activity parameter, the camera awareness phenomenon cannot be excluded without further investigation.

The results confirm once again the major influence of the learning group size upon the educational process, suggested elsewhere (Gage & Berliner, 1979; Adar et al., 1981). It may be noted that there is an explicit resemblance between the rhythms of large and medium size groups both before and after the workshop, in spite of conspicuous differences in their absolute scores. This applies to both the activity and the cognitive parameters. It is suggested that the results indicate a similar flow of events reflecting similar instructional approach in the two kinds of groups, which also changed together after the workshop. However, it is noteworthy that after the workshop the scores of the medium-size group on the activity dimension coincided with those of the small ones, indicating that teachers have learned how to

activate 15 students as they do with four. In other words, the structure of the lessen in the medium-size groups remained as if they were a large one, yet individual attention was achieved as if they were a small one. Again a change in the direction of the flow of information is suggested.

Nevertheless, the activity rhythm of small groups after the teacher training, although static by definition, shows a more pronounced decline than any other. This may be attributed directly to the small number of learners. The new approach to instruction put a large demand on students' cognition. While in the medium and large groups this demand is shared by many students, who can replace each other yet produce the same TDS score, here it is the same one to four students who have to comply all along the way. The result is a fatigue phenomenon which reflects their need in time of "retirement" in order to think. This assumption is strongly supported by contrasting the activity rhythm of small groups with the cognitive one.

It may be further noted that the only case in which a "dynamic rhythm" was preserved to some extent after the workshop is the cognitive parameter in small groups. Although the results cannot definitely establish that dynamic rhythm is inherent to small groups, it well may be the case. The adherent interpersonal relationship in such a group provides a mutual reinforcement of cognition, creating an "intellectual empathy" between teacher and group members which is not very different from the emotional support which is typical of small groups.

SUMMARY AND CONCLUSIONS

It is suggested that a four-day teacher training workshop may bring forward a major change in instructional behavior, which may even reflect an attitudinal change in self perception of the teacher's role. It is

further suggested that a study of the rhythm of an educational encounter may provide valuable information on its nature.

However, too many questions are yet to be answered. It is thus strongly recommended that the study of rhythms continue. One may wish to select different time units along the lesson, a different training program, various group sizes and additional parameters in order to eliminate some of the alternative explanations brought up here. Above all, any change which may be observed should be measured in the light of the institutional objective and the desired instructional approaches.

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Table 1

Criteria for Scoring Activity and Cognitive Levels*

Score	Activity Level		Cognitive Level	
Low ↓	a_1	Teacher lectures	b_1	knowledge
	a_2	Teacher questions	b_2	comprehension
	a_3	Teacher responds, reacts	b_3	application
	a_4	Student answers, responds	b_4	analysis
	a_5	Student asks, questions	b_5	synthesis
High	a_6	Student initiates	b_6	evaluation

* Adopted from the Technion Diagnostic System (Perlberg, et al., 1974).

Table 2

Mean Scores and Standard Deviation for the Pre- and Post-Training Workshop Lessons in the Various Learning Groups

	Activity Level		Cognitive Level	
	Pre-Workshop	Post-Workshop	Pre-Workshop	Post-Workshop
Small Groups (1-4 learners)	212.64 ±90.65* (N=33)	229.19 ±132.38 (N=12)	210.84 ±102.84 (N=33)	240.81 ±76.87 (N=12)
Medium Size Groups (5-15 learners)	179.17 ±65.82 (N=89)	243.25 ±82.17 (N=91)	177.03 ±75.55 (N=89)	209.39 ±73.10 (N=91)
Large Groups (16-50 learners)	146.13 ±48.02 (N=58)	198.40 ±73.31 (N=57)	146.52 ±64.41 (N=58)	166.09 ±57.14 (N=57)
Mean	169.80 ±70.30 (N=180)	218.10 ±79.90 (N=161)	165.03 ±78.08 (N=180)	185.71 ±60.80 (N=161)

* Standard Deviation

Table 3

Mean Scores and Standard Deviation for the Various Time Units in Different Group Sizes Before and After the Training Workshop

	PRE-WORKSHOP			POST-WORKSHOP		
	Small (N=33)	Medium (N=89)	Large (N=58)	Small (N=12)	Medium (N=91)	Large (N=57)
			ACTIVITY LEVEL			
time unit 1	205.14 ±93.14	179.08 ±71.63	141.22 ±51.10	248.10 ±162.15	250.89 ±90.86	211.16 ±95.61
time unit 2	215.46 ±91.92	179.09 ±64.62	157.33 ±62.67	234.00 ±136.13	240.78 ±84.29	191.48 ±73.58
time unit 3	236.20 ±106.69	175.96 ±74.23	146.44 ±53.08	233.90 ±140.67	231.70 ±78.05	194.48 ±79.29
			COGNITIVE LEVEL			
time unit 1	191.57 ±103.17	176.25 ±83.40	140.84 ±60.34	239.90 ±105.13	211.87 ±78.47	167.70 ±63.81
time unit 2	211.26 ±112.12	181.82 ±81.76	159.45 ±86.22	243.30 ±88.97	213.69 ±79.73	167.48 ±68.10
time unit 3	216.80 ±115.89	180.29 ±93.00	147.75 ±73.66	248.40 ±89.33	205.66 ±82.34	161.89 ±65.88

Table 3

Mean Scores and Standard Deviation for the Various Time Units in Different Group Sizes Before and After the Training Workshop

Time Units	Small Groups		Medium Size Groups		Large Groups	
			ACTIVITY LEVEL			
	Pre (N=33)	Post (N=12)	Pre (N=89)	Post (N=91)	Pre (N=58)	Post (N=57)
1st time unit	205.14 ±93.14	248.10 ±162.15	179.08 ±71.63	250.89 ±90.86	141.22 ±51.10	211.16 ±95.61
2nd time unit	215.46 ±91.92	234.00 ±136.13	179.09 ±64.62	240.78 ±84.29	157.33 ±62.67	191.48 ±73.58
3rd time unit	236.20 ±106.69	233.90 ±140.67	175.96 ±74.23	231.70 ±78.05	146.44 ±53.08	194.48 ±79.29
			COGNITIVE LEVEL			
1st time unit	191.57 ±103.17	239.90 ±105.13	176.25 ±83.40	211.87 ±78.47	140.84 ±60.34	167.70 ±63.81
2nd time unit	211.26 ±112.12	243.30 ±88.97	181.82 ±81.76	213.69 ±79.73	159.45 ±86.22	167.48 ±68.10
3rd time unit	216.80 ±115.89	248.40 ±89.33	180.29 ±93.00	205.66 ±82.34	147.75 ±73.66	161.89 ±65.88

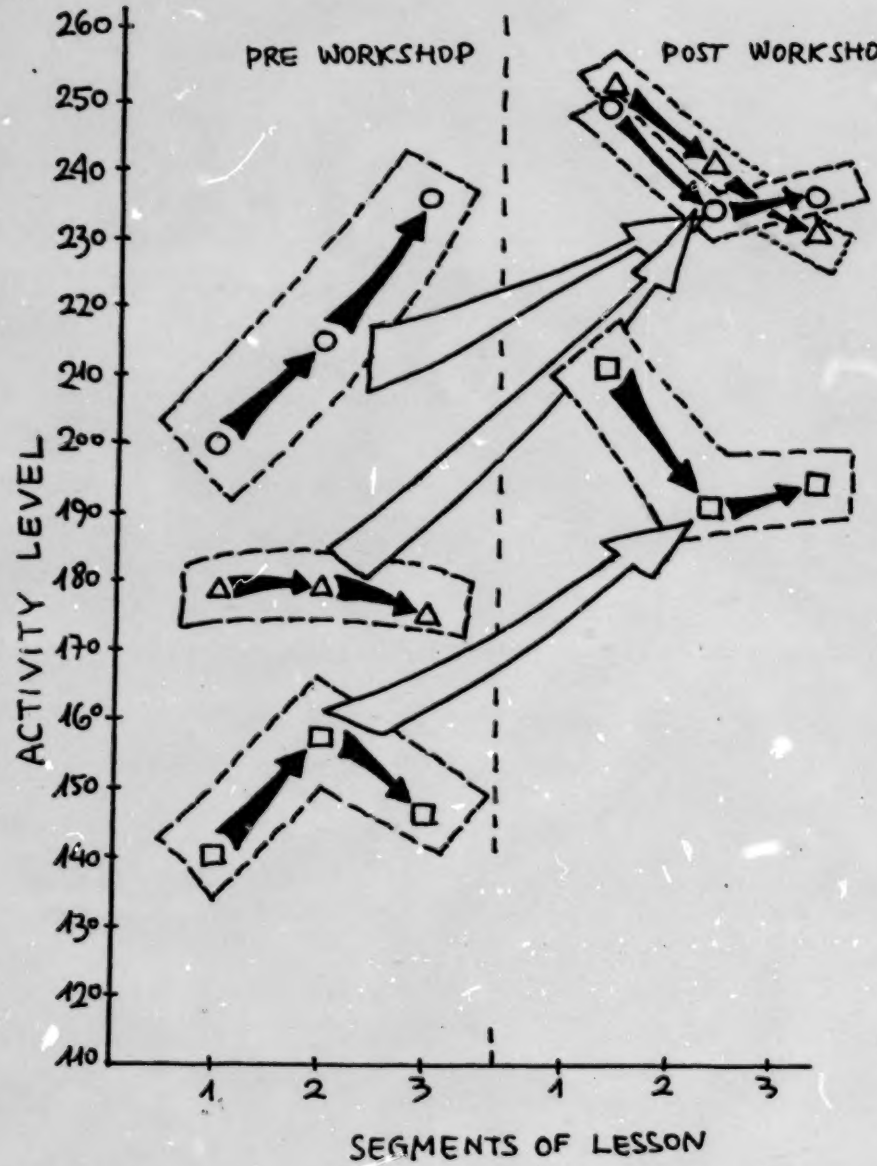
Table 4

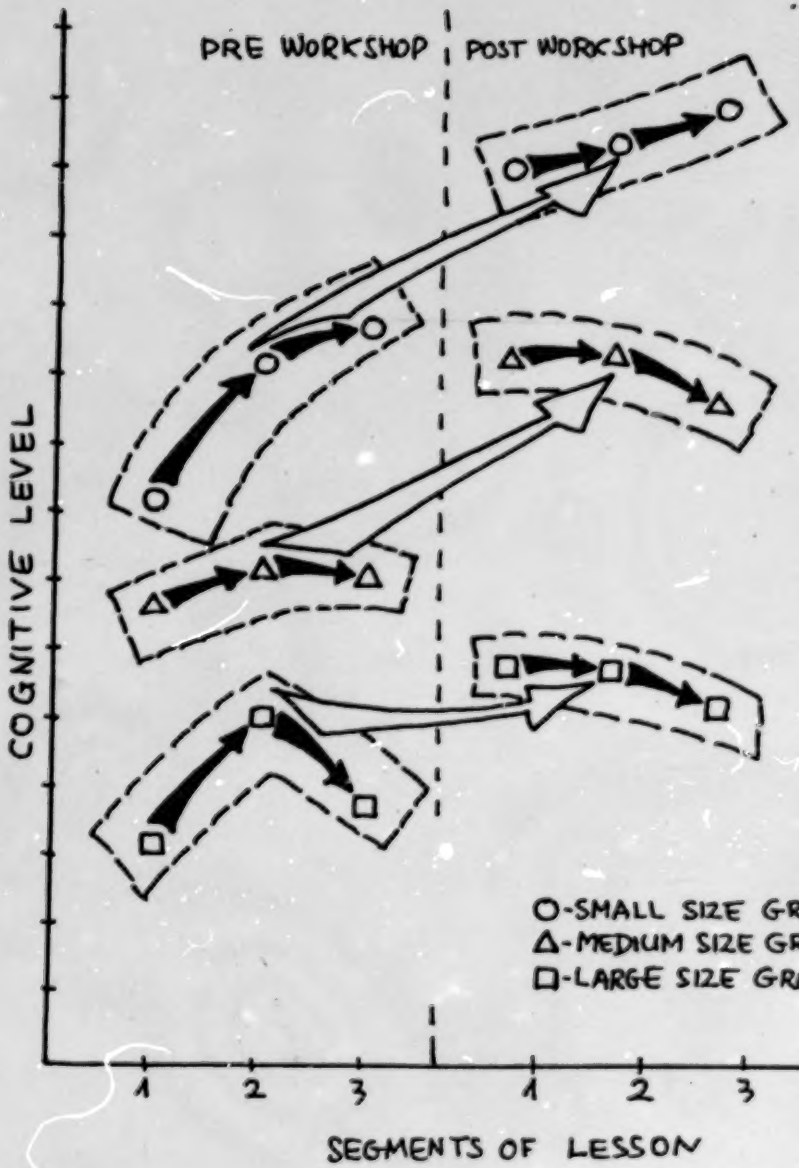
Analysis of Variance of Activity and Cognitive Level Scores in Various Learning Groups Before and After the Training Workshop

	Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
ACTIVITY LEVEL						
Main effects	Treatment	247828.44	1	247828.44	44.10	.001
	Group Size	149532.92	2	74766.46	13.30	.001
Two-way Interaction		17610.49	2	8805.24	1.57	.210
Explained Variance		391669.30	5	78333.86	13.94	.001
Residual		1877071.16	334	5619.97		
Total		2268740.46	339	6692.45		
COGNITIVE LEVEL						
Main effects	Treatment	63103.77	1	63103.77	11.58	.001
	Group Size	177793.47	2	88896.73	16.32	.001
Two-way Interaction		2917.01	2	1458.51	.27	.765
Explained Variance		225219.14	5	45043.83	8.27	.001
Residual		1819327.29	334	5447.09		
Total		2044546.44	339	6031.11		

Figure Caption

Figure 1: Pre- and Post-Workshop Rhythms of Lessons in Cognitive and Activity Parameters, according to Learners' Group Size


PRE WORKSHOP
POST WORKSHOP
ACTIVITY LEVEL
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
1
2
3
1
2
3
SEGMENTS OF LESSON


PRE WORKSHOP
POST WORKSHOP
COGNITIVE LEVEL
O-SMALL SIZE GR
Δ-MEDIUM SIZE GR
□-LARGE SIZE GR
1
2
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1
2
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SEGMENTS OF LESSON